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Rehabilitation R & D Progress Reports 1990

V. Geriatrics

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For additional information on topics related to this category see the following Progress Reports: [334], [375], [385], [502], [513], [528], [620].

[154] Interventions to Improve Dressing Behavior in Cognitively Impaired Veterans

Cornelia M. Beck, RN, PhD; Patricia Heacock, RN, PhD; Susan Mercer, DSW

John L. McClellan VA Medical Center, Little Rock, AR 72205; University of Arkansas for Medical Sciences, Little Rock, AR 72202

Sponsor: VA Rehabilitation Research and Development Service (Project #E558-RA)

Purpose—The purpose of this study is to examine the difference in dressing assistance that subjects require before and after receiving the clinical intervention of Strategies for Promoting Independence in Dressing (SPID), a set of environmental and interactional behavioral strategies.

Data collection has been completed on two nursing home care units at the John L. McClellan VA Medical Center. Data analysis is complete for one of the two units.

Methodology—A pretest/posttest design was used in which each subject served as his own control. The dependent variable was the level of dressing assistance required, as measured by the Beck Dressing Performance Scale (BDPS). Descriptive data collected on each subject included: 1) the Mini Mental Status Exam (MMSE); 2) the Neurobehavioral Cognitive Status Exam (NCSE); and, 3) the Cognitive Skills for Dressing Assessment (CSDA). The NCSE and the CSDA were used to help determine each subject's remaining cognitive abilities which could be utilized during dressing, and disabilities that precluded the subject from being successful with certain activities.

Nine conveniently selected subjects with dementia in a long-term care unit at a VA Hospital were videotaped during dressing twice for 1 week to desensitize the subjects and caregivers to videotaping. Then, baseline data were collected by videotaping subjects dressing twice a week for 2 weeks. The clinical treatment, SPID, which consists of specific environmental and interactional interventions, was taught to caregivers in a standardized 8-hour training program which included didactic content, role-playing, and return demonstration. Interventions were individualized to each subject's specific abilities and disabilities by a doctorally prepared geropsychiatric nurse in consultation with a neuropsychologist. During

the 6-week treatment period, caregivers were videotaped twice a week during dressing interactions and given weekly feedback and encouragement by the investigators who viewed videotapes weekly to monitor compliance to the intervention protocol. Posttreatment data were collected twice a week for 2 weeks. Data collection videotaping stopped for 3 weeks during which no feedback or encouragement was provided to the caregiver. Follow-up data were collected twice a week for 1 week. Each dressing interaction was rated for the level of caregiver assistance, using the BDPS, by two masters-prepared gerontological nurses who were blind to the time sequence of the videotapes.

Results—The nine subjects, all male veterans, had a primary diagnosis of dementia or Alzheimer's disease. The mean age was 73.89 (sd=7.06) and the mean MMSE score was 6.22 (range 0 to 13).

To determine the mean treatment effects, average scores on the BDPS were determined for the four baseline, four posttreatment, and two follow-up videotapings. Mean BDPS scores showed the level of caregiver assistance decreased from 6.23 (sd=1.88), needing occasional physical guidance, at baseline to 4.67 (sd=1.99), needing repeated verbal prompts, during postintervention and decreased again to 4.25 (sd=2.49) during follow-up observations. The significance of the apparent improvements in the mean BDPS over time was assessed by the paired *t*-test and by Wilcoxon's sign rank test. All comparisons were significant at the 0.05 level or better.

Future Plans/Implications—As more subjects are added to the sample, a time-series analysis will be used to determine when the maximum treatment effect occurs and more stringent statistical tests will be used to determine significance levels of treatment effects. In addition, the

time taken for each dressing interaction is being recorded to allow for time and effort and cost comparisons in the larger sample.

This research provides evidence that caregiver assistance which is carefully matched to the cognitive abilities

and disabilities of the resident can decrease the amount of caregiver assistance needed and that this change can be maintained over time. These findings show great promise for improving the lives of demented older adults by beginning to identify interventions that promote independence.

[155] Detection and Prevention of Loss of Balance in the Elderly: A Pilot Study

Eric E. Sabelman, PhD; Melissa G. Hoy, PhD; Carol H. Winograd, MD

Rehabilitation Rehabilitation and Development Center, VA Medical Center, Palo Alto, CA 94304; Geriatrics Research, Education and Clinical Center, VA Medical Center, Palo Alto, CA 94304

Sponsor: VA Rehabilitation Research and Development Service (Project #E972-PA; Project #E601-RA)

Purpose—The motivation for studying balance in the elderly is to reduce the likelihood of falling, a major cause of morbidity, mortality, and loss of independence in this population. Most balance assessment methods concentrate on the lower body and the relationship of the body's center of mass to the position of the feet. However, control of orientation of the trunk with respect to gravity is a significant factor in maintaining balance. Motion sensors at two locations (i.e., the head and waist) should suffice to detect falls and balance instabilities. Confining observation to the upper body limits information on patterns of gait, but permits trunk motion and head-pointing direction, indicative of attention to direction of movement, to be more readily distinguished.

Our goal is to develop a wearable accelerometric instrument, a "balance orthosis," making it possible to record an individual's movements during everyday activities in a nonlaboratory setting, and identify patterns of movement that accompany loss of balance before a fall actually occurs, alerting the individual of pre-fall behavior, and if necessary, signaling a remote attendant that a fall has taken place. To develop the necessary algorithms for distinguishing harmless from pre-fall motions, we have been testing subjects in the laboratory using elements of standard qualitative balance assessment protocols.

Methodology—In a typical laboratory test, subjects stand barefoot with feet apart and arms held at sides or on hips. Three-axis accelerometers are attached to the front and side of the forehead and waist using Velcro and elastic straps. Sensor outputs are digitally recorded at 20 readings per sec. To record body movement, reflective tape markers are attached to legs, trunk, arms, and head; these are conventionally videotaped and videophotographed at high contrast by a motion analysis system.

Subjects then perform up to 20 tasks, including: 1) standing with eyes open, then closed, for 15 sec; 2) climbing up three steps, turning, then going down three steps; 3) rising from, then sitting in a chair at normal speed; 4) tandem (toe-to-heel) walking as fast as possible for 10 ft; and, 5) walking over 2-, 4-, and 8-inch obstacles placed 3 ft apart.

Results—Elderly subjects had baseline lateral and pitch acceleration but more and higher peaks of 0.01 G or more, increasing to about 0.05 G in the pitch axis with eyes closed. Climbing down stairs produced peaks at the young subject's head (smoothed relative to the waist), but in elderly subjects, peaks were higher and sharper. The finding of amplification of acceleration peaks at the head in the elderly, instead of damping as in the young, is consistent with stiffening of shock-absorbing soft tissues such as intervertebral discs, resulting in transmission of more foot impact up the vertebral column to the head.

Twenty-five elderly (aged 64 to 85 years) and 5 young (24 to 29 years) female subjects were tested during the pilot phase. Data from tests of rising and sitting in a chair were analyzed by deriving the antero-posterior (pitch) angle of the trunk and the difference between this angle and pitch angle of the head. The time average of the angle indicated a shift in orientation of the body relative to vertical, or of the head relative to the body; a high standard deviation indicated unsteadiness in the pitch plane. While young subjects' means varied randomly between trials, elderly subjects' mean head-to-body angles were more often consistently positive or negative (tilting forward or backward). Standard deviation of four elderly subjects sitting down ranged from 0.1 to 0.53; only two were within the same 0.04 to 0.18 range as young subjects. Standard deviation of elderly subjects was

bimodal; eight were similar to young subjects while five ranged from 1.0 to 3.4 during rising, implying that the accelerometric method can distinguish steady from unsteady individuals. Most elderly as well as young subjects were no more unsteady when rising fast than when rising at normal speed; one of eight showed prolonged settling after completing the rise.

The trunk angle relative to vertical during rising from a chair measured by accelerometers at the waist was consistently less than that derived from video image analysis of the line between hip and shoulder markers. The image analysis method could be overestimating the tilt angle, since it cannot distinguish in-plane motion from rotation, while the accelerometers have a subject-specific shift due to body contour; this can probably be corrected by mounting one sensor in back instead of in front.

The stepping-over-blocks test is a new addition to the balance assessment protocol; it was performed by only three subjects. One elderly subject was clearly similar to a young person in antero-posterior head-to-body angle (mean of -0.1 to $+0.15$, SD 0.8 to 1.2), while another had a mean angle of 0.24 to 0.42 radian and SD of 0.24 to 0.34 in three trials. This occurred in an individual with less confidence in her balance, who looked at her feet before stepping over each obstacle.

Future Plans/Implications—An expanded project (#E601-RA) has been approved for VA support. This 3-year project includes: 1) further development of hardware for measuring relative upper-body accelerations; 2) refinement of present software for analyzing data to yield head and torso velocity vectors in real-time; 3) continued laboratory testing of well-defined motion sequences typical of activities of daily living (e.g., talking while walking, reaching for and manipulating objects, walking over curbs and ramps of various heights, and opening doors); 4) continued comparison with simultaneous measurement of displacement by image analysis to verify accuracy of results; 5) expansion of the subject population to include postsurgical patients, whose progress toward independent living is more rapid than that of the fall-prone elderly; 6) expansion to include institutionalized and community-living subjects; 7) integration of accelerometric analysis with other balance diagnosis techniques (one such, the “Equitest,” will permit controlled stimulation of falls); and, 8) exploration of reinforcement of fall-avoidance behavior modification using accelerometric feedback.

If successful, the “balance orthosis” project will directly benefit a subset of the fall-prone population who have recognizable pre-fall motion patterns, and indirectly benefit others by improving clinical diagnosis of balance disorders.

[156] Design of a New Toilet: Transfer and Access Pilot Study

Pascal M. Malassigne, MID, IDSA

Rehabilitation Research and Development Center, VA Medical Center (Atlanta), Decatur, GA 30033

Sponsor: VA Rehabilitation Research and Development Service (Project #E951-PA)

Purpose—This study was aimed at collecting data on preferences of disabled people in their daily use of the bathroom. In addition, this study sought to collect data on the approach, access, and transfer from a wheelchair to a toilet fixture by people capable of independent transfer (e.g., paraplegics, low quadriplegics, hemiplegics, victims of polio, amputees, etc.).

Progress—The Rehabilitation Research and Development Center collaborated with the Paralyzed Veterans of America to develop an illustrated survey on the daily use of the bathroom by disabled people. The survey was divided into three categories: use of the toilet, the lavatory, and the bathtub or shower. For each category, readers were asked to comment on their preferred technique of

approach, transfer, and use of the fixture, as well as the type of assisting devices they used. In addition to personal data and type of disability, the survey sought information on the types of modifications the respondents had made in their homes.

Results—The survey was sent to 1800 randomly selected *Paraplegia News* subscribers, and 800 questionnaires were returned—a 45% return rate. The disabilities of persons responding fell into seven categories: quadriplegics, 15%; paraplegics, 45%; multiple sclerosis, 25%; victims of polio, 5%; hemiplegics, 2%; amputees, 1%; other disabilities, 3%. Responses were broken down into the seven disability categories and two age groups.

Fifty-nine years of age and older. 1) Side and lateral transfers to the toilet: quadriplegics, 50%; paraplegics, 37%; multiple sclerosis, 38%; polio victims, 31%; hemiplegics, 20%; amputees, 0%; all other disabilities combined, 20%. 2) Frontal transfer: quadriplegics, 50%; paraplegics, 63%; multiple sclerosis, 62%; polio victims, 79%; hemiplegics, 80%; amputees, 100%; and all other disabilities, 80%.

Less than 59 years old. 1) Side and lateral transfers: quadriplegics, 68%; paraplegics, 48%; multiple sclerosis, 30%; polio, 22%; hemiplegics, 12%; amputees,

16%; all other disabilities combined, 22%. 2) Frontal transfer: quadriplegics, 32%; paraplegics, 52%; multiple sclerosis, 70%; polio, 78%; hemiplegics, 88%; amputees 84%, and 78% of all other disabilities.

Implications—These responses clearly indicate that the traditional technique of transferring from the side is no longer the only method used by disabled people. This is a major finding which justifies rethinking the design of a fixture that was not originally meant to be accessed from a seated position.

[157] Spatial Orientation and Wayfinding in Elderly Persons

Bruce B. Blasch, PhD; Rickilyn M. Mancil

Rehabilitation Research and Development Center, VA Medical Center (Atlanta), Decatur, GA 30033

Sponsor: VA Rehabilitation Research and Development Service (Project #E428-RA)

Purpose—A major problem for many elderly persons is that of becoming lost or disoriented while attempting to move about familiar environments while engaged in everyday life activities. In a past survey of 170 nursing homes, it was found that such disorientation characterizes a significant proportion of the nursing home population.

The component processes of wayfinding, particularly among older individuals, are poorly understood. In order to provide a better understanding of the wayfinding abilities of older persons, this 3-year study examined: 1) the ability of older people to find their ways around new and unfamiliar places; 2) changes in wayfinding abilities as people age; and, 3) variances in abilities of older and younger people to find their ways around new and unfamiliar places.

Individuals of two specific age groups were compared in a novel, institutional setting. The comparison included the efficiency of wayfinding, which involves the components of: 1) knowledge of the environment; 2) knowledge of one's location in relation to specific landmarks in the environment; and, 3) retrieval and usage of this information. Factors related to wayfinding competence in the elderly were studied in the residential setting, and included: 1) frequency and range of travel; 2) wandering behavior; and, 3) memory.

Methodology—This study consisted of two parts. Part 1 was a comparison of measures of spatial ability in an unfamiliar building following a brief, controlled exposure to the building with 34 young and middle-aged adults (18-50 years), and 34 older adults (65 and up). Elderly

adults selected for participation were individuals recently admitted to a large retirement center, since one objective of the overall project was to compare their performance on this controlled task with spatial behavior in a more natural setting (i.e., the independent living center). Part 2 was a follow-up of the older adults after their admission to the retirement center. It was designed to examine the relationship between wayfinding competence, as measured in Phase 1, and various measures of adjustment to the nursing home. The subjects' spatial orientation and wayfinding competence in the nursing home and immediate environment, self-confidence in wayfinding, range of travel, wandering behavior, memory and general level of function at 2 weeks, 2 months, 6 months, and each 6-month interval thereafter for a period of 2 years was to be assessed.

Older adults selected for participation were individuals who had recently (within 2 weeks) moved into a large retirement center. Middle-aged adults were selected among recently hired employees and/or volunteers of the VA Medical Center (VAMC), Decatur, GA.

Progress—All of the middle-aged volunteers have been identified and tested in a novel environment at the VAMC, Decatur, GA. Data analysis is well underway with this group.

Nine of the 22 original volunteers in the older group have discontinued participation, having had multiple health problems and been advised by their physicians to stop, or they have died. Longitudinal data is being collected on these 13 participants. Several of these older adults have also been tested in VA's novel environment.

Results—Data are currently being analyzed.

Future Plans/Implications—The results of this study will have implications for understanding the effects of the aging process on spatial orientation and wayfind-

ing. In addition, this study will have applied implications for orienting older adults to new environments. There are hopes that depression and adjustment to new settings will be lessened because of the knowledge gained.

[158] Motivational Devices for Promotion of Aerobic Exercise in the Elderly

Gerald F. Fletcher, MD; Franklin K. Coombs

Rehabilitation Research and Development Center, VA Medical Center (Atlanta), Decatur, GA 30033

Sponsor: VA Rehabilitation Research and Development Service (Project #E425-RA)

Purpose—The objective of this 2-year project was to evaluate the influence of exercise enhancement devices on the attitude and perception of exertion of young, middle-aged, elderly, and wheelchair-confined subjects. The use of different age groups is intended to ascertain whether preference in environmental conditions during solitary exercise is age-related. However, due to a limited time factor, the young age group was dropped.

Methodology—After completing an initial submaximal exercise test and psychological tests, each of the 60 ambulatory subjects selects either a treadmill or a stationary bicycle upon which to exercise. The wheelchair subjects are limited to a modified exercise roller. The same device is used under all three of the experimental exercise conditions. One of the exercise conditions has the subject interacting with the device in a game-like protocol (i.e., a cartoon-figure walking a dog reflects the physiological and motor reactions of the exercising subjects). The video display is designed to be fun, challenging, and to motivate the user to exercise in his/her target heart rate zone, keeping the user safely within the limit of their exercise prescription. The second condition involves a noninteractive video display of exercise views in pleasant environments (i.e., environment scenery as the camera is moved at a bicycling or running pace). The third condition involves stationary exercise without the use of any motivational devices. The subject's heart rate is only seen by the technician but if the subject exercises

at an intensity above his/her range, the program shuts off and that particular session is terminated.

Progress—All experimental testing has been completed. Data from 58 subjects has been analyzed, with two others in the process of being coded. Preliminary results were submitted for presentation at the 1990 Annual Meeting of the American Association of Cardiovascular and Pulmonary Rehabilitation.

Results—In a preliminary analysis of the data, exercise efficacy was assessed in 58 older, healthy adult subjects (mean age 63.8 years). Effects of condition (Exercise Alone, Exercise plus Video Tape, or Exercise plus Video Game) on perceived level of exertion, mean heart rate during the session, time-in-target heart rate, and total time in the session were studied. A series of one-way analyses of variance with repeated measures and appropriate *post hoc* tests revealed that the time-in-target heart rate and perceived level of exertion were significantly greater in the Exercise plus Video Game condition. We conclude that exercise training efficacy seems enhanced under that condition due to the subject's interaction with the video game.

Future Plans/Implications—A follow-up phone survey 1 year from now will be conducted to see if the subjects are compliant with the exercise prescriptions given to them at the end of the sessions.

[159] Assessment of Age-Related Changes in Visual Spatial Organization

Thomas L. Amerson, PhD; Donald H. Mershon, PhD; Laura A. Gilliom, BA

Rehabilitation Research and Development Center, VA Medical Center (Atlanta), Decatur, GA 30033; Department of Psychology, North Carolina State University, Raleigh, NC 27605

Sponsor: VA Rehabilitation Research and Development Service (Project #C426-RA)

Purpose—This was a 3-year study of age-related changes in visual function and the judgment of egocentric distance, depth, and apparent size. In the study, visual performance was assessed on 128 normal-sighted individuals from two age groups (20-35 and 55-70 years of age). The participants' performance on a battery of clinical and psychophysical tests of vision (e.g., contrast sensitivity, macular stereopsis, tonic vergence, and near and far acuity) was compared with their judgments of distance, depth, and size in reduced and enhanced cue environments. These data are being used to determine relationships among basic visual function, age, and elements of spatial organization. At the completion of the data analysis (December 1990), a baseline evaluation existed upon which comparisons with other groups (e.g., older, low-vision observers) may be made.

Methodology—All participants in this study were given clinical screenings to exclude the presence of age-related pathology such as glaucoma, cataracts, or macular degeneration. All participants had at least 20/30 near and far acuity (corrected). Upon reporting to the laboratory, each participant was further screened for lateral and vertical phorias, contrast sensitivity, and visual field extent. A computer-driven test of tonic vergence was administered by the Parameter Estimation by Sequential Testing (PEST) protocol. The observers were then presented nonfamiliar ("anomalous") target objects of different physical sizes and requested to make judgments of egocentric distance and size. In some conditions ("dynamic trials"), the observer walked a specific distance toward the object and made the distance and size judgments. A similar format was used with a familiar target object (an "Exit" sign). Distance and target size judgments were also made to 1 × 2 ft targets placed outside the laboratory at 67 ft and 185 ft from the observer and viewed under full cue conditions. A novel test of the judgment of short depth intervals was provided through the repeated presentation of a simulated "staircase" in

which the inter-step separation was randomly varied from 4 to 12 inches. A cross-modal response was elicited by having the observer move a step-like apparatus, by foot, until the separation was judged to be the same as the apparent inter-step separation viewed. Each observer made judgments of the inter-step depth under both unrestricted and restricted (approximately 14 degrees) viewing conditions.

Progress—Data collection incorporating the above methodology was completed in July 1990. Data analysis and preparation of manuscripts is ongoing. The project ended in December 1990.

Results—The results of the "staircase" part of the study are available. Older adult subjects were found to be as able as younger ones in separating their feet by a verbally-specified amount (a "calibration" task done without visual input). Male subjects generally did better at matching the required separations for the larger values. Both young and older subjects did reasonably well in judging the height of stair steps presented visually. A restricted view, however, resulted in less accurate judgments, with older subjects benefiting relatively more by an increase in the viewing aperture. The older subjects showed a significantly greater underestimation of the larger stair steps when a restricted view was used, than when viewing the steps without restriction. The presence of an edge-tape to mark the front of each step had an interactive effect with step size and age, but no major effect.

Future Plans/Implications—This study should establish normative data for future studies which will investigate the effects of age-related pathology upon visual distance, depth, and size perception. Additionally, this study supports other laboratory research concerning the human factors of safety and mobility in architectural environments.

[160] Knowledge-Based System for Selecting Elopement-Control Devices

Franklin Coombs, MS; Bettye Rose Connell, MS; Jon A. Sanford, MArch

Rehabilitation Research and Development Center, VA Medical Center (Atlanta), Decatur, GA 30033

Sponsor: VA Rehabilitation Research and Development Service (Project #E586-2RA)

Purpose—In order to provide safer environments for demented patients who wander, this study will develop a knowledge-based system to aid in selecting devices to control elopement in nursing homes. The study will produce a computerized database that uses expert judgments as a basis for matching the most effective types of interventions with facility-specific considerations, including building design, staffing patterns, policy, and patient profiles. The knowledge base is intended for use by administrators and health facility designers to aid them in making more informed decisions about the most appropriate device for a specific facility.

Methodology—This study entails a five-step process to: 1) identify prototypical facility descriptions (including typical building layouts, staffing patterns, institutional policies on wandering, and patient profiles); 2) obtain recommendations from health care and facilities experts on the requirements for elopement control devices; 3) identify products that meet the stated requirements; 4) evaluate the responsiveness of the commercially available devices in meeting the stated requirements; and, 5) create the knowledge-based system.

“Typical” VA and “exemplary” nursing home plans have been obtained in order to identify facilities that represent a variety of layouts of typical VA Nursing Home Care Units, as well as private exemplary facilities (e.g., those that have received design awards or are considered to be precedents for other facilities).

Site visits to a minimum of 15 facilities are being conducted in order to obtain information about the facility in-use. The site visits are being used to obtain information on how the building is used—that is, the interactions among building design, routine activities of occupants, and state and institutional practices. This information is being gathered through group interviews of five to seven staff members who are directly involved in patient care (e.g., primary care staff, social workers, etc.), interviews with nursing home administrators, and tours of the facilities.

In addition, nursing home administrators are asked to provide several types of information: patient demo-

graphics, frequency of elopement incidents, institutional policies regarding different types of wandering, staffing patterns, the type and degree of various wandering behaviors, the number of staff per shift, and routine patterns of activity.

Prototypical nursing home descriptions describing the building design, staffing, patient attributes, institutional policies and wandering problems for each nursing home are being developed. These descriptions will provide the basis of the discussion in the health care/facilities experts workshop.

Expert consultants in gerontology, nursing home administration, geriatric health care, health facilities architects, etc., will be identified to participate in a 3-day workshop.

A Health Care and Facilities Experts Workshop will focus on the prototypical nursing home descriptions as the basis for selecting appropriate interventions to address the problem of elopement.

Input from manufacturers of elopement control devices will be obtained through a review of the device requirements determined by the consultant panelists. Manufacturers will be asked to recommend elopement control device(s) that would meet those requirements, and provide nonproprietary, detailed technical and performance specifications on those products.

Electrical/electronic engineers will review the manufacturers' recommendations in order to determine: 1) if, and to what extent, the devices have the technical capability to meet the requirements; and, 2) whether the devices will function in accordance with the claims of the manufacturers.

Database development will result in a multidimensional matrix of nursing home designs, staffing characteristics, patient profiles, and institutional policies. This will be used to identify solutions that most closely meet the requirements of a specific nursing home.

Progress—Plans of VA and exemplary nursing homes have been analyzed, sites identified, and approximately half of the site visits have been completed.

[161] Environmental and Behavioral Factors in Falls Among the Elderly

John A. Templer, PhD; Bettye Rose Connell, MS

Rehabilitation Research and Development Center, VA Medical Center (Atlanta), Decatur, GA 30033

Sponsor: VA Rehabilitation Research and Development Service (Project #E539-RA)

Purpose—The specific aims of this study are to: 1) identify and describe the role of salient environmental and behavioral factors in fall and near-fall events among institutionalized elderly persons; 2) compare the relative accuracy of primary data on fall events (e.g., video records) with postincident self-report data (e.g., fallers' verbal reconstructions) and secondary data (e.g., falls incident reports); and, 3) assess the acceptability of the data collection methodology, from the participants' perspective. The long-term objective of this study is to use research to design and evaluate interventions which help to reduce the occurrence of falls among the elderly.

Methodology—The study is being conducted at the Atlanta Veterans Affairs Medical Center (VAMC) Nursing Home. Current alert residents with a history of falling have been invited to participate in this study. This pool of potential participants will be supplemented over the course of the study with new residents who have a history of falling and current residents who develop a problem with falling. Motion-activated, video technology will be used to record naturally occurring fall and near-fall events. No falls will be induced. Participants' nonfall incidents, matched on intended activity and time of day, will serve as control data. Background information will be obtained on participants' visual, sensory, neurological, and cardiovascular functioning using accepted clinical procedures. In addition, participants' overall health status and current medications will be documented.

For approximately 2 months, video technology will be used to record all activities in participants' rooms, including fall, near-fall, and nonfall events. Following a fall or near-fall, participants will be interviewed to reconstruct the event from their perspective. Fall incident reports (completed by Nursing Home staff) also will be obtained. An exit interview with each participant will

determine participants' attitudes toward the video methodology. Environmental and behavioral factors involved in fall and near-fall events will be coded and statistically analyzed. The role of architectural characteristics will be further examined using floor plan analysis techniques.

Progress—Cables have been installed on both floors of the Nursing Home Care Unit to facilitate installation and relocation of the recording equipment as needed. The motion-based video recording system has been assembled, and technical fine-tuning has been completed to assure that a close-to-comprehensive record of incidents in the recording areas is obtained. The first of approximately nine data collection cycles (up to four rooms with at least one resident with a history of falling per room) has been completed. A systematic procedure for reviewing and editing the raw data video tapes has been developed and implemented. The follow-up procedures to reconstruct incident events and obtain Fall Incident Reports, as well as a systematic process to obtain current medical and background data, have been developed and implemented. The draft codebook, which is needed to transform the video, interview, archival, and sensory/medical data into an analyzable form, is completed and being evaluated.

Results—While an insufficient amount of data has been collected to date to permit any systematic form of analysis, several trends have been observed. First, the resident population of the Care Unit is currently more frail than in the recent past, and the frequency and types of near-falls that have been observed (e.g., frequent dependence on objects to steady balance, loss of balance following apparently minimal deviation from an upright stance) seem consistent with what would be expected. Second, over the first 8-week period of video taping, 35 near-falls and one fall have been observed. These incidents involved four participants.

[162] Systematic Observation of Wandering Behaviors in Older People and Contributing Factors

Bruce B. Blasch, PhD; David Martino-Saltzman, PhD

Rehabilitation Research and Development Center, VA Medical Center (Atlanta), Decatur, GA 30033

Sponsor: VA Rehabilitation Research and Development Service (Project #E402-RA)

Purpose—The purpose of this study was to capture and describe the unique patterns of travel of nursing home residents labeled “wanderers” and to explore the relationships between the expression of these travel patterns and a variety of psychological and nonpsychological factors. The following research questions were addressed in this study: 1) What kinds of travel behaviors constitute wandering activity? 2) How do psychological factors such as dementia and depression affect wandering? 3) Do nonpsychological factors like demography, previous occupational demands, or physical impairments play a role in wandering? 4) Is medication an important contributing factor to wandering? and, 5) What are the risks associated with the expression of wandering travel behaviors?

Methodology—This study used an observational methodology based on video monitoring to capture the travel behaviors of nursing home residents, a portion of which had been identified by nursing staff to be wanderers. Travel behaviors were evaluated by two independent raters using a reliable coding scheme developed for this study. All participants were evaluated with respect to cognitive and emotional status, demography, and medication regimens. Participants were classified as efficient or inefficient travelers based on travel behavior and compared with respect to a variety of factors.

Progress—A total of 30 subjects have completed the study protocol at one site. The coding scheme has been developed and interobserver reliability determined. Results for these 30 subjects have been analyzed and are summarized below.

Results—In general, nursing home residents’ travel was efficient in that routes traveled were relatively direct from one location to another. However, a number of residents also engaged in travel behaviors that were inefficient, including repetitively lapping areas (circuiting) and/or random patterns of movement (meandering). Participants

were categorized into two groups composed of individuals whose travel was always efficient ($n=10$) and those who exhibited either meandering or circuiting at least twice a week ($n=8$). Comparisons between these groups revealed that differences were limited to cognitive factors. No differences were found with regard to demography, physical demands of previous occupations, physical disabilities affecting activities of daily living, or the prescription of psychotropic medication. Although both groups appeared cognitively impaired based on their total Dementia Rating Scale scores, the inefficient travel group was much more profoundly impaired. Impairment of recent memory ability was the most important factor that separated the two groups. A significant but modest temporal association between exiting supervised areas and inefficient travel behaviors (circuiting or meandering) was found, which suggested exhibition of these behaviors was not without some degree of risk for elopement. Finally, the emergence of these behaviors was interpreted to be symptomatic of the later stages of Alzheimer’s disease.

Future Plans/Implications—Replication of the study protocol with 10 more participants from the current study site is now underway. Video taping has been completed for these participants and over half of their events have been coded. Following completion of coding and analyses of these data, the study will continue at another site to increase total sample size to 80 participants. Results to date have shown that wandering activity can be objectively measured using an observational methodology based on video monitoring. In the future, development of a technology to electronically map the travel patterns of the elderly will be explored.

Recent Publications Resulting from This Research

A Systematic Observation of Wandering Behaviors and Psychologic Correlates (Abstract). Martino-Saltzman D, Gerontological Society of America Annual Scientific Meeting, 1989.

[163] Predicting Wayfinding Ability from Laboratory-Based Spatial Tasks

Richard G. Long; James Grissett, PhD; Bruce Blasch, PhD

Medical Sciences Department, Naval Aerospace Medical Research Laboratory, Pensacola, FL 32508; Rehabilitation Research and Development Center, VA Medical Center (Atlanta), Decatur, GA 30033

Sponsor: VA Rehabilitation Research and Development Service (Project #D525-RA)

Purpose—The primary goal of this 3-year study is to ascertain whether measures of microspatial (tabletop tests) abilities are related to wayfinding abilities in macrospatial (real world) environments. Relevance of this question to the Department of Veterans Affairs lies in the fact that many disabled veterans, such as those who are elderly or have sensory or cognitive deficits, may experience problems in mobility and spatial cognition. The ability to accurately identify handicapped individuals at risk for disorientation would ultimately facilitate intervention in spatial orientation. Relevance to the Department of Defense lies in the fact that many military activities, such as aviation and troop movement, require good spatial orientation, wayfinding, and map-reading skills in unfamiliar and adverse situations. If measures of “tabletop” or paper-and-pencil spatial abilities correlate moderately or well with large space wayfinding, then it may be possible to use microspatial tasks for screening and selection of military personnel for jobs requiring a high degree of spatial ability.

Methodology—To complete this research, subjects ranging in age from 18 to 35 years will be given a battery of “tabletop” or paper-and-pencil spatial tests from the *Kit of Factor Referenced Cognitive Tests*, (Ekstrom, French, and Harman, 1976) which tap various aspects of this complex behavioral domain (e.g., spatial visualization, memory for spatial information, spatial closure). They will also perform a set of tasks which involve viewing a 5 × 7 ft model town, and responding to questions which tap perspective verification and map verification. Finally,

subjects will walk predetermined routes inside a building, and outside in wooded areas and residential areas. After these walks, subjects will perform tasks which tap general Euclidian orientation, feature recognition, temporospatial ordering of landmarks, map placement of landmarks, and route reversal. Difference in mobility in residential and rural settings is of interest because differences in the familiarity, quantity, and salience of environmental information between city and forest will likely affect wayfinding. Data analysis will involve multiple regression analyses in which measures of macrospatial ability serve as the criterion variables and psychometric and experimental tasks serve as predictors.

Progress—Data are currently being collected in this project. Preliminary analyses of data were conducted in the first quarter of FY 1991.

Implications—This study will identify which types of microspatial tasks show a valid and reliable relationship to selected macrospatial tasks, and the magnitude of those relationships. It may be possible, for example, to use the findings as a basis for the establishment of norms for spatial behavior across age, and thus help in determining the differential effect of normal aging and sensory or cognitive decline as they affect spatial behavior. It may also be possible to extend this work to the identification of compensatory strategies which can be taught to civilians and military personnel in need of enhanced mobility or wayfinding skills.

[164] Why Don't All Impaired Elderly Fall?

Stephanie Studenski, MD, MPH

VA Medical Center, Durham, NC 27705

Sponsor: VA Rehabilitation Research and Development Service (Project #E538-RA)

Purpose—The purpose of this study is to clarify the role of impaired mobility in falls among older people. Mobility function can be described in a hierarchical framework.

Impaired mobility is proposed to be a functional manifestation of losses across the components of postural control. Impaired mobility is proposed to be a necessary

but not sufficient factor in chronic falls. Impairments in psychologic, social and environmental domains also contribute to falls risk.

Methodology—The protocol is designed in three phases. Phase 1 identifies subjects with impaired mobility. Phase 2, an in-home examination, identifies the degree of impaired mobility and screens for contributions from the other three domains. Phase 3 examines the neuromusculoskeletal contributors to postural instability in a laboratory setting. Community-dwelling male veterans aged 70 or older are eligible. Clinical measures include: a progressive mobility skills protocol with established hierarchical properties; a functional reach task; psychologic and cognitive measures; instruments to assess social support; and, a structured environmental assessment based on pathway theory. Laboratory instruments include a motor-driven platform fitted with strain gauges, surface electro-

myography, videocameras and software for motion analysis, and isokinetic dynamometry. Measures include visual functions, analysis of EMG and body segment kinetics in both feedforward and feedback paradigms, peak torque, goniometry, and timed clinical endurance testing. The outcome, falls, is monitored with daily diaries and telephone contacts.

Progress—There are 202 subjects aged 70-104 (median 76) enrolled to date. Based on the mobility skills screen, 94 have been assigned to a low risk category and 108 to a high risk category.

Results—To date, there have been 87 falls in 42 individuals. Seven percent of low risk and 32% of high risk subjects have fallen at least once. Two or more falls have occurred in 1% of low risk and 17% of high risk subjects.

[165] Age-Related Changes in Sensory-Motor Performance

Barbara M. Myklebust, PhD; Joel B. Myklebust, PhD
Clement J. Zablocki VA Medical Center, Milwaukee, WI 53295

Sponsor: VA Rehabilitation Research and Development Service (Project #C390-2RA)

Purpose—The goal of this research is to achieve an integrated understanding of the changes which occur in sensorimotor performance as healthy people grow older. The data will be used to identify functional differences in elderly individuals who are “at risk for falls,” who have a history of unsteadiness or falling. Alterations in the neural signal processing, muscle strength, joint stiffness, walking, and postural steadiness will be compared in healthy elderly subjects and in elderly persons who are unsteady or who have a history of falls.

Our “template” of sensorimotor performance in healthy aging will also be used to compare healthy elderly subjects with patients with neurologic or orthopedic disease, or lower limb prostheses.

Methodology—We are developing a database of performance measures of healthy aging subjects (ages 45 to 84 years). We are objectively evaluating the neuromusculoskeletal system (myotatic reflexes, joint compliance, muscle strength, simple ankle-joint voluntary movements, somatosensory evoked potentials), and systemic functional integrity (standing balance and gait). We will perform the same measures on elderly community

dwellers and residents of the Geriatric Nursing Unit who are unsteady or who have a history of falling.

Progress—Despite the fact that our healthy aging volunteers are physically active, most have deficits in at least one of our test measures. However, our active healthy aging subjects have fewer sensory-motor deficits than previously described for elderly subjects. Some of our measurements will be useful tools to discriminate “healthy” aging from individuals who are unsteady or at risk for falls. Some of our tests indicate significant differences in all healthy older subjects; these tests will be useful in identifying general risk factors for falls.

Results—In healthy aging subjects, we have identified nine types of deficits in biomechanical, electrophysiologic, neurologic, and functional parameters: absent or delayed reflexes, impaired tandem walking, reduced velocity of gait, altered joint interactions in gait, reduced reaction times, altered joint compliance, muscle weakness, impaired sensation, and frontal release signs. We consider these deficits as risk factors for falling and unsteadiness. We will compare the types, prevalence, incidence, and magnitude of risk factors in older subjects

who do not feel unsteady, with those who feel unsteady or have a history of falls. We have assessed standing balance in Alzheimer's disease (AD) patients who are unsteady and have impaired gait by clinical examination. We have developed a simple, objective method to quantify deviations in balance by determining the fractal dimension "D" of the curve which describes the center of pressure during standing. The mean value of D was significantly different for 11 healthy elderly subjects (1.86 ± 0.33) than for 14 AD patients (1.73 ± 0.18). For the AD group, balance was less impaired with eyes closed than open. Severity of balance impairment correlated significantly with degree of cognitive impairment. We have evaluated the gait of nine unsteady, "frail" elderly nursing home residents. These patients (ages 62 to 100 years), are generally deconditioned, and do not have neurological or orthopedic diseases. For the population, all objective measures of gait (gait cycle duration, percent stance, stride length, velocity, and equivalent cadence) differ from measures for healthy elderly subjects by from 2 to 3 standard deviations. The effect of exercise on these patients is being assessed.

Future Plans—Disorders of balance and stability are among the most significant health problems of the aging population; falls are a major cause of mortality, morbidity, immobility, and premature nursing home placement. Our research demonstrates that a diversity of changes may occur in active, aging persons who do not have neurological or orthopedic diseases. Older persons who feel unsteady may have a number of sensory, motor, or neuro-

logical deficits which put them at risk for falling. We suggest that the aging process and risk factors for unsteadiness are multi-faceted problems. A goal of our comprehensive, multi-dimensional studies is to identify routine tests which clinicians can use to identify and treat patients at risk for falling, and that therapeutic regimes can be developed to prevent, treat, or compensate for deficits which place elderly people at risk for falls.

Recent Publications Resulting from This Research

- Cadence as a Functional Measure of Gait (Abstract). Alba H, Arch Phys Med Rehabil 71:818, 1990.
- Determining the Frequency Content of Gait Kinematic Measurements: Implications for Data Acquisition and Analysis. Myklebust B, Myklebust J, in Proceedings of the Sixth East Coast Clinical Gait Conference, 1990.
- Development of Control in Gait: Proposed Joint and Limb Interactions. Myklebust B, Myklebust J, Prieto T, in Proceedings of the First World Congress on Biomechanics, 1:95, 1990.
- Dimensionality of Postural Steadiness (Abstract). Myklebust J et al., Soc Neurosci Abstr 16:1315, 1990.
- The Frequency Content of Human Gait: Kinematic Sagittal-Plane Measurements (Abstract). Myklebust B et al., Soc Neurosci Abstr 16:1319, 1990.
- Postural Control in Healthy Aging Subjects. Myklebust J, Myklebust B, Hu QT, in Proceedings of the 13th Annual RESNA Conference, Washington, DC, 215, 1990.
- A Review of Myotatic Reflexes and the Development of Motor Control and Gait in Infants and Children: A Special Communication. Myklebust B, Phys Ther 70:188-203, 1990.
- Standing Balance Measures in Alzheimer's Disease. Antuono PG, Myklebust BM, Myklebust JB, in Proceedings of the Second International Conference on Alzheimer's Disease and Related Disorders, 1990.
- Strengthening and Aerobic Exercise in Nursing Home Residents (Abstract). Sauvage LR et al., Clin Res 38:819A, 1990.

[166] Seat Angle as a Therapy for Patients with Osteoporosis

Angelo A. Licata, MD, PhD; D.C. Neth, MS; S.P. Mars; E.T. Reyes; S.I. Reger, PhD

Department of Musculoskeletal Research, The Cleveland Clinic Foundation, Cleveland, OH 44195

Sponsor: Cleveland Clinic Foundation; Edison BioTechnology Center

Purpose—Osteoporosis is an age-related disorder characterized by decreased bone mass and increased susceptibility to fractures. Clinical observations indicate that spinal extension reduces the level of pain experienced by the patient. A pilot study has been conducted to investigate the relationship between seat angle and spinal extension in patients with osteoporosis. The hypothesis is that significant extension of the spine can be accomplished in osteoporotic patients by increasing the angle of the seat and thereby increasing anterior pelvic tilt.

Methodology—The subjects for the study consisted of nine female patients diagnosed with osteoporosis. The patients were placed in a Balans chair which had been modified to allow a range of seat angles from 0 to 30 degrees. Reflective markers were placed on the forehead, chin, C7, T6, L1, sacrum, anterior superior iliac spine (ASIS), trochanter, femoral condyle, and seat. A video tracking system was used to record the position of the markers. Three samples were taken at seat angles of 0, 5, 10, 15, 20, 25, and 30 degrees. Segment length and angle

information were determined through software analysis of the video data.

Preliminary Results—Regression of the T6-C7 angle and seat angle and a regression of the angle between the T6-L1 and L1-S segments and seat angle were not statistically significant. However, it is apparent from the data that both spine angles decrease as the seat angle increases. Preliminary analysis supports the stated

hypothesis: the increase of the lordosis and the decrease of kyphosis indicate an increase in spinal extension as the seat angle and anterior pelvic tilt are increased.

Recent Publications Resulting from This Research

The Relationship Between Seat Angle and Spinal Extension in Patients with Osteoporosis. Neth DC et al., in Proceedings of the 13th Annual RESNA Conference, Washington, DC, 105-106, 1990.

[167] Use of Technology to Promote Rehabilitation of Older Persons: Reducing Barriers to Independence

James Watzke, PhD; David B.D. Smith, PhD; Nancy Somerville, BS

Rehabilitation Research and Training Center on Aging, University of Southern California/Rancho Los Amigos Medical Center, Downey, CA 90242; Project Threshold, Rancho Los Amigos Medical Center, Downey, CA 90242

Sponsor: *National Institute on Disability and Rehabilitation Research*

Purpose—Disabilities often make it difficult for the older person to function maximally at home; such persons are also at increased risk of injury through accidents. The effective incorporation and use of environmental features are central to the safety and rehabilitation of the older person, i.e., to maintain independence, prevent further disability, reduce family worry, and prevent institutionalization. Although technology has been widely used to solve problems of rehabilitation, this has not been particularly true in geriatric rehabilitation.

This project's ultimate goal is to develop a sub-center on technology within the Rehabilitation Research and Training Center on Aging. Focusing on safety problems in the older disabled persons' homes, a set of critical problems will be identified. Existing commercial products designed to solve such problems will be tested in the home and/or laboratory setting, and modifications and developments of products will be conducted to fill identified problem-technology gaps.

Dissemination activities are an important component of this project. The dissemination activities include the production of a home safety resource notebook, preparation of articles for publication, the development of product utilization workshops, and the presentation of information at conferences concerned with geriatrics, rehabilitation, or human factors.

Progress—This 5-year project is now midway through year three. First, a comprehensive literature base was compiled. Based on a review of this literature, as well as the National Electronic Injury Surveillance System

(NEISS) data, it was decided to focus the project on three major accident categories: falls, burns/scalds, and medication intake errors. The next major goal was to identify a universe of critical in-home safety problems for disabled elderly. This was accomplished by reviewing previous work on safety and the older person, as well as interviewing a sample of 30 health-care professionals whose primary responsibilities include in-home assessments with older persons.

Using the list of identified in-home safety problems, year two of the project focused on identifying existing commercial products which have the potential to alleviate these safety problems for disabled seniors. Using assistive device catalogues, ABLEDATA, and clinical expertise, approximately 200 such products were identified, organized according to the safety problems they address, and placed into a database. This safety-assistive device database will be maintained throughout the project. Next, work began on a "Home Safety Resource Notebook." This book is intended for a wide range of readers (professionals, caregivers, and seniors), and will present the safety problems as well as suggested behavioral and technological solutions from the project. The book attempts to treat safety and technology topics with slightly more depth than previously published such resource guides. It will also provide thorough information as to where the featured products can be obtained. A final draft of the book should be ready early 1991.

Future Plans—The balance of the project will be occupied with hands-on product testing and development.

A sub-selection of the products identified earlier in the project will be brought into our laboratory for evaluation. The parameters to be addressed in this evaluation include the efficacy of the product in solving the environmental, functional, and/or psychological problems related to each accident category. Issues of user-friendliness will also be studied. These data will come from hands-on participa-

tion of disabled seniors in this phase of the project; i.e., they will be in the laboratory helping us evaluate the products. Based on these evaluations, a numerical "product evaluation score" will be obtained. This score is intended to provide a method by which other professionals and lay persons can easily understand our evaluation of each product.

[168] Attitudes Of and Toward Older Persons with a Disability: Their Measurement and Their Role in Rehabilitation

Judith M. Mitchell, PhD

Rehabilitation Research and Training Center on Aging, Downey, CA 90242

Sponsor: *National Institute on Disability and Rehabilitation Research*

Purpose—Supportive attitudes and accurate knowledge of the rehabilitation of older adults with disabilities can go a long way in furthering successful health care. Conversely, negative attitudes and lack of knowledge regarding rehabilitation care of geriatric patients can be detrimental to patient rehabilitation outcomes. The patient's family and physician play a large part in determining the level of the older person's adjustment, level of functioning, health status, and life satisfaction. The attitudes of these three key parties can be crucial and act as either facilitators or inhibitors of the rehabilitation process. For example, attitudes may influence patient motivation, support and assistance given by the family, and patient treatment by the physician. To date no instruments exist that specifically measure attitudes toward older adults with disabilities.

This study is a 5-year project funded to develop psychometrically sound scales that measure attitudes of and toward older persons with a disability, and to investigate geriatric rehabilitation outcomes in relation to attitude patterns among the family, the doctor, and the patient. These findings will highlight which attitudes interfere with which rehabilitation outcomes, and disseminate information on how to reduce these barriers.

Progress—Development of an attitude scale is in its final stages. A final draft of the *Attitudes Toward Older Adults with Disabilities Scale* contains 60 items drawn from existing attitudinal scales, consultation with professionals in gerontology and geriatrics, and consultation with disabled older adults. The scale has attempted to include the three major types of items based on Fishbein and Ajzen's concept of attitudes, which are affective orientation,

attitudinal beliefs, and behavioral intention. The items address content areas of social, psychological, functional, and societal attitudes, and personal reactions toward the disabled older adult. This scale has been distributed to 300 persons ranging in age from 18 to 90 in a local community.

Results—Internal consistency for the five content areas range from 0.50 to 0.84, with an average of 0.70. Significant relationships exist between attitude scores and education and age, with positive attitudes related to higher levels of education ($F=9.63$, $p<0.001$) and decreased age ($F=12.80$, $p<0.001$). Validity studies are planned for the future which will compare attitude scores with a semantic differential measure of attitudes toward disabled older adults, and attitudes of groups identified as having unusually "good" attitudes (i.e., professionals who specialize in geriatrics or gerontology), "neutral" attitudes (the general public), and "bad" attitudes (group not yet identified). Other validation studies are also in the planning stages.

Future Plans/Implications—Once the final version of the scale is complete and validity studies have been done, this scale will be used to test the influence of attitudes upon the rehabilitation process and outcomes of geriatric inpatients. Attitudes of family members, the patient's physician, and the patient him/herself will be explored. It is hoped that understanding the influence and patterns of attitudes toward older disabled adults will help facilitate rehabilitation success and point out where attitude changes are needed. Education regarding disability in old age may be one way to change harmful attitudes. Hopefully, this scale will encourage research

on the impact of attitudes toward the disabled older person and how to reduce the negative ageism that exists toward this group.

Information on the development of the attitude scale was presented at the American Society of Aging Conference in April 1990, in San Francisco.

[169] Late-Life Effects of Early-Life Disability: Comparisons with Age-Matched Controls on Indicators of Physical, Psychological and Social Status

Bryan Kemp, PhD; Kenneth Brummel-Smith, MD; Margaret L. Campbell, PhD
Rehabilitation Research and Training Center on Aging, Downey, CA 90242

Sponsor: *National Institute on Disability and Rehabilitation Research*

Purpose—Many persons with disabilities are now living to later life but experiencing the onset of new medical, psychosocial, and functional problems. Two of the largest such groups are people with post-polio and spinal cord injury (SCI). Post-polio individuals are experiencing primarily fatigue, weakness, pain, and loss of strength. The SCI population is experiencing multiple medical problems which include osteoporosis, renal disease, hypertension, respiratory and cardiovascular problems, and generalized amyloidosis. Although increasingly these problems are described in the clinical literature, to date little systematic research has focused on the long-term consequences of an early life disability. The purpose of this project is to correct this shortcoming by conducting a well-controlled study comparing early-life disabled individuals (post-polio and SCI), age-matched nondisabled, and late-onset disabled persons (such as those with stroke and diabetes).

The objectives of this study fall into two separate categories. First, we will focus on a variety of medical, psychological, and social variables to determine if there are differences between our four subject groups. In this way we can assess to what extent the changes reported are due to aging alone, to duration of disability, or to a com-

bination of factors including life style. Second, we will look more closely at the aging person with an early-life onset disability: 1) to determine if there are gender differences in health and functional changes associated with aging and/or life style; 2) to determine the kinds of services these individuals need in order to continue their independence in the community; and, 3) to gather additional data to test a compensation hypothesis as a major factor in late-life sequelae to early-life onset of disability.

Progress—In the third year of a 5-year study, major activities have focused on subject identification and recruitment, data collection, instrument revisions, and creation of a computerized sample accounting and data management system to track subjects and sub-samples across various stages of data collection. Information is being collected via questionnaires, in-depth interviews, and clinical assessments by a team consisting of a physician, psychologist, physical therapist, and family sociologist. Our achieved sample to date includes 70 post-polios, 21 SCI, and 35 nondisabled. Subject recruitment for the fourth group of late-onset disabled individuals began in Fall 1990. We anticipate completing data collection a year later in the Fall of 1991 with an total sample of 250.

[170] Interdisciplinary Human Development Institute Consortium on Aging and Developmental Disabilities

M.C. Martinson, PhD; James A. Stone, MS, FAAMR
University of Kentucky, Lexington, KY 40506-0051

Sponsor: *National Institute on Disability and Rehabilitation Research*

Purpose—The Interdisciplinary Human Development Institute (IHDI) cooperates with the Universities of Cincinnati, Akron, Minnesota, Illinois-Chicago, and Indiana University in a consortium effort as the Research and Rehabilitation Training Center on Aging and Developmental Disabilities.

The purposes for the IHDI component are to design, develop, and field-review interagency models for long-term fiscal support of small-scale community living options for older persons with developmental disabilities, and to make projections for training and technical assistance.

Methodology—The research component is based on five goals: 1) develop a value-based planning process to ensure consideration of criteria for quality of life based on maximum continuing personal life choices and social integration for older persons with developmental disabilities; 2) improve fiscal efficiency of programs via interagency funding models that support small-scale community living options for older persons with developmental disabilities; 3) identify effective small-scale community living options that respond to individual need, personal choice, and community integration for older persons with developmental disabilities; 4) develop and disseminate a resource document on interagency planning model(s) that integrates value-based planning processes; effective options for small-scale community living, and fiscally efficient long-term funding to support small-scale community living options for older persons with developmental disabilities; and, 5) design and develop training materials and technical assistance procedures for interagency planning for long-term funding to support small-scale community living options for older persons with developmental disabilities.

Progress/Results—A national survey of state mental retardation/developmental disabilities agencies was completed on March 30, 1990. Forty-seven of 51 surveys were returned. Brief highlights from the surveys are: 1) 19,570 older persons with developmental disabilities are residing

in small-scale community living options—the largest percentage reported was board-and-care homes (18.6%); 2) 1.5% of the older persons were living independently; and, 3) for each older person living in community options with federal funding, 2.5 older persons live in community living options supported by state funding.

The data analysis produced enough information to proceed with the four working papers scheduled for dissemination by September 30, 1990: (a) Volume One Number One: *Results of a National Survey of State Mental Retardation/Developmental Disabilities Agencies Serving Older Persons with Developmental Disabilities*; (b) Volume One Number Two: *Current Fiscal Models for Supporting Small-Scale Community Living Options for Older Persons with Developmental Disabilities*; (c) Volume One Number Three: *Quality of Life Issues for Older Persons with Developmental Disabilities*; and, (d) Volume One Number Four: *Interagency Taskforce Planning for Older Persons with Developmental Disabilities*.

Information and technical assistance on these issues have been provided at the Midwest Congress on Aging in Kansas City, the South Carolina Divisions of Aging and Mental Retardation, the American Association on Mental Retardation Conference in Atlanta, and the Southeastern Region's UAP Conference on Aging and Developmental Disabilities in Atlanta. A monograph is planned for completion by June 30, 1991.

[171] Rehabilitation Research and Training Center Consortium on Aging and Developmental Disabilities

Jack H. Rubinstein, MD; Ruth S. Roberts, PhD; David Braddock, PhD; Tamar Heller, PhD; Alan Factor, PhD; Barbara A. Hawkins, ReD; Susan Eklund, PhD; William Martz, PhD; M.C. Martinson, PhD; James Stone, MS; Deborah Anderson, PhD; Harvey L. Sterns, PhD; Evelyn Sutton, MA; Ann McCracken, PhD, RNC; Charlotte Spicher, PhD, RNC; Thomas J. Lottman, BSc; Gary M. Seltzer, PhD; Mariellen Kuehn, PhD
University Affiliated Cincinnati Center for Developmental Disorders, Cincinnati, OH 45229; University of Illinois at Chicago, University Affiliated Program on Developmental Disabilities, Chicago, IL 60608; Indiana University, Institute for the Study of Developmental Disabilities, Bloomington, IN 47405; University of Kentucky, Interdisciplinary Human Development Institute, Lexington, KY 40506; University of Minnesota, Minnesota University Affiliated Program on Developmental Disabilities, Minneapolis, MN 55455; University of Akron, Institute for Life-Span Development and Gerontology, Akron, OH 44325; University of Cincinnati, College of Nursing and Health and the University Affiliated Cincinnati Center for Developmental Disorders, Cincinnati, OH 45221; University of Wisconsin-Madison, Waisman Center on Mental Retardation and Human Development, Madison, WI 53705

Sponsor: National Institute on Disability and Rehabilitation Research

Purpose—The Rehabilitation Research and Training Center (RRTC) Consortium on Aging and Developmental Disabilities is committed to improving the community integration of older persons with mental retardation (MR)

and other developmental disabilities (DD) through the combined efforts of a consortium of seven universities (Illinois, Indiana, Kentucky, Minnesota, Wisconsin, Akron, and Cincinnati) in six states.

Progress—The Center's research and training program serves as a national resource for researchers, planners, service providers, and consumers by increasing knowledge about this previously neglected population of older persons with DD, and ensuring availability and utility of this knowledge base to the policy, planning, and service delivery of both generic aging and specialized MR/DD agencies. The current research program includes nine research projects in four areas of concentration: 1) fiscal and program policy analysis; 2) detection of decline; 3) transition reactions and family support; and, 4) collaborative training investigations.

Methodology—Coordinated research efforts are being completed in the respective area of concentration of each of the nine research projects. (Information is available on each of the nine research projects upon request.) At the completion of the third year of this research program (June 1991), the findings of the nine research projects will provide a basis for an integrated research and training program for years four and five. This integrated program will involve both a state-of-the-art research study on improving the functioning of older persons with MR/DD which has the potential of establishing a direction for future research, and a national dissemination plan targeting research, planning, service, and consumer groups. In addition, persons with MR/DD and their family members participate during all phases and at all levels of the RRTC's research and training activities.

Results—Specific research results are not available at this time, but major outcomes have occurred or are projected through national linkages, consumer participation, and implementation of a research and training program. Three groups targeted by the RRTC are: 1) administrators, planners, and policy makers; 2) service providers; and, 3) individuals with developmental disabilities and their families. Some projected outcomes include: deter-

mining future directions for research in aging and DD; developing reliable fiscal/program databases for planning services; recommending future policy that reflects the community integration of older persons with DD; providing technical assistance for networking with generic aging and DD services; identifying prevention strategies for coping with relocation and change for older people with DD; creating models for community-based living arrangements; designing assessment instruments for detecting age-related change; preparing people with DD and their families for life changes; improving the community integration of older persons with DD through accessibility to generic services; and, involving older persons with MR/DD and their family members as advisors and committee members to guide in all phases and at all levels of the research and training program.

Principal investigators and staff of the RRTC have provided the following: internships/practica for 32 students; 118 in-service training sessions; 166 professional presentations; 961 technical assistance contacts; and have disseminated over 52,000 pieces of information on aging and developmental disabilities. In addition, a Clearinghouse on Aging and DD has been established to provide information concerning the community integration of older persons with MR/DD. The Clearinghouse responded to 2,065 requests for information. A quarterly newsletter with a circulation of nearly 6,000, the *A/DD Vantage*, is published to raise awareness of the many and diverse issues related to aging and MR/DD.

Future Plans/Implications—It is the intent of the RRTC Consortium on Aging and DD to improve the quality of life and integration in the community for older persons with MR/DD. The integrated intervention study based upon the research findings of the RRTC, to be piloted by the RRTC in 1992, will serve as a national model to begin accomplishing this goal.

[172] Patterned Urge-Response Toileting for Incontinence

Joyce C. Colling

Oregon Health Science University, School of Nursing, Portland, OR 97201

Sponsor: *National Center for Nursing Research, National Institutes of Health*

Purpose—The overall purpose of this project was to test the efficacy of a noninvasive, behavioral treatment called Patterned Urge-Response Toileting (PURT) on urge/functional urinary incontinence among nursing home

residents. The specific aims of the project were to test the effect of PURT on: 1) the frequency of urinary incontinent episodes and associated volume of urine among incontinent nursing home patients; 2) the incidence of

complications (e.g., skin irritations and urinary tract infections) among incontinent nursing home patients; 3) the psychosocial well-being of incontinent nursing home patients; 4) the behavioral capabilities of incontinent nursing home patients; 5) the knowledge about urinary incontinence and attitudes of nursing personnel toward caring for incontinent patients; and, 6) facility costs for incontinence care.

Methodology—PURT is an individualized behavioral treatment program for decreasing urge/functional urinary incontinence (UI) among nursing home patients. The treatment strategy consists of a refinement of habit training, but instead of imposing a training schedule on patients, an ambulatory electronic monitoring device is used to obtain the exact timing of voiding occurrences for three consecutive 24-hour days for each patient in the study. The voiding pattern of each patient is precisely identified and translated into an individualized toileting prescription for staff to follow, which reinforces the natural voiding pattern of the patient.

The electronic monitoring device used was the Urinary Incontinence Monitor (UIM), a device which recorded and stored data on the occurrence of incontinence by means of a temperature thermistor when urine at core body temperature was expelled. Data were recorded in minute intervals in real clock time, then dumped directly into a computer for analysis by means of a software program written for this purpose. The device was no larger than 2×3 inches with solid state components.

Results—Eighty-eight subjects from four nursing homes completed the 36-week project. The treatment reduced incontinence by an average of 0.9 urinary voiding episodes per day, which was a statistically significant

change with respect to the subjects' baseline and in comparison with the performance of the control group. Incontinence levels declined for one-third of the treatment group by more than 20%. However, compliance rates of the indigenous nursing staff, who carried out the program under the supervision of research staff, were only 70%, which may have dampened the maximum effect of the treatment. The improvement in continence did not significantly affect the incidence of urinary tract infections, skin rash, skin breakdown, or psychosocial status; however, statistical significance was achieved with behavioral capabilities with elimination, achievement/motor skills level, and dependency status.

Direct costs of labor, supplies, and linen were also determined for incontinence and toileting care. Cost savings occurred in linen and supplies, while labor cost actually increased.

Future Plans/Implications—The current standard of UI management in nursing care is to change/toilet patients at the convenience of the staff rather than at times when patients need to void. This is not only time-consuming for staff, embarrassing and disruptive for the incontinent individual, it is also potentially inaccurate by as much as 59 minutes. The UIM is accurate, nonintrusive, and does not require frequent staff attention. (This device is expected to benefit and appeal to nursing homes where the incontinent rate is now over 50%, and among certain people in the community where the rate of incontinence is about 15%.) However, it takes staff longer to toilet patients than to change them after they are wet, which provides little incentive for staff to change their behavior toward more toileting. Thus, the standard of nursing care around UI management must be altered for a strategy such as the one described in this project to be incorporated into nursing practice.

[173] Managing Lower Urinary Tract Dysfunction in Aging Women

Molly Dougherty, RN, PhD

J. Hillis Miller Health Center, University of Florida, Gainesville, FL 32610

Sponsor: *National Center for Nursing Research, National Institutes of Health*

Purpose—The goal of this project is to manage lower urinary tract dysfunctions in aging women. Currently, the effect of exercise and biofeedback on stress urinary incontinence (SUI) and mixed (SUI and urge) incontinence, respectively, are under study.

Progress—In earlier research, methods to assess intravaginal pressure developed during voluntary contractions of the pelvic muscles (PM) and a PM exercise protocol were tested. Reproductive-age women in normal health demonstrated significant improvement in intravaginal

pressure after 6 weeks of exercise at home. Reproductive-age women with SUI obtained significant improvement in incontinence and intravaginal pressures after 6 weeks of PM exercise at home. Research on the intensity and duration of PM exercise necessary to significantly increase intravaginal pressure in healthy, aging women was undertaken.

Methodology—A series of 11 custom-fitted intravaginal balloon devices (IVBD) to measure the pressures developed by the PM were used. To monitor abdominal pressure, a 0.25×1×2 cm posterior balloon device (PBD) was fabricated and positioned in the posterior fornix of the vagina. At the baseline assessment, an alginate (Healthco International, Boston, MA) impression of the vagina was obtained; the impression was used to match an IVBD from the series to the subject. The water-filled PBD and IVBD were attached to strain gauge pressure transducers and a dual channel strip-chart recorder. The system was opened to atmospheric pressure and calibrated with a mercury manometer prior to placement of the IVBD and PBD in the vagina. Tracings reflecting pressures developed by the CVM during relaxation and contraction and abdominal pressures were obtained.

The intervention was a graded program (increased every 3 weeks) of regular (3 times per week, every other day) PM exercise at home lasting 12 weeks. The exercise program began with sessions requiring 15 repetitions of a 12-second contraction of the PM. Ten repetitions were added every 3 weeks, resulting in 45 repetitions during the final (fourth) interval. An audio cassette tape recording was provided to guide the exercise sessions.

Analog and digital data were obtained on the IVBD and PBD during 10 contractions representing maximum,

sustained contractions of the PM for 12 seconds and the corresponding abdominal pressure. These data were obtained at baseline and at four exercise levels. Characteristics of the pressure curves analyzed included: 1) maximum pressure (MP10); 2) minimum pressure (MinP10); and, 3) sustained pressure (SP10).

Results/Implications—The sample (N=85) was between 35 and 78 years of age (mean 52.6; SD 10.6). Multivariate analysis of variance showed that there were statistically significant differences among the exercise levels for the variables MP10, MinP10, and SP10. Significant increases in intravaginal pressure occurred after exercise intervals 1, 2, and 3, on each of the three pressure curve variables. Significant improvement did not occur at level four on two study variables. It may be that 35 repetitions per session represents the optimal exercise intensity.

Our results indicate that improvement occurs with exercise intensity at levels lower than that reported in the incontinence literature. Questions about the relationship between the mechanisms of continence and PM exercise merit further investigation. Valuable comparative data on the pressure curves will become available when we complete our study on aging women with SUI.

Recent Publications Resulting from This Research

The Effect of Circumvaginal Muscle (CVM) Exercise. Dougherty MC et al., *Nurs Res* 38(6):331-335, 1989.

The Effect of Exercise on the Circumvaginal Muscles in Postpartum Women. Dougherty MC et al., *J Nurse Midwifery* 34:8-14, 1989.

Stress Urinary Incontinence: Effect of Pelvic Muscle Exercise. Ferguson KL et al., *Obstet Gynecol* 75:671-675, 1990.

[174] Cognitive and Emotional Profile of Neuropsychiatric Disorders

Paul Fedio; E. Mohr

National Institute of Neurological Disorders and Stroke, National Institutes of Health, Bethesda, MD 20892

Sponsor: *National Institute of Neurological Disorders and Stroke, National Institutes of Health*

Purpose—A neuropsychological profile was plotted for individuals with Alzheimer's (AD), Huntington's (HD), or Parkinson's (PD) disease. The evaluations extended into memory, learning, and perception, utilizing standard and experimental tasks, and also established normative references for functional changes accompanying the aging processes.

Results/Implications—The results revealed common as well as specific deficits, implicating involvement of different brain structures. Specifically, AD is accompanied by marked deficits in selective attention, episodic memory, and visuospatial disturbances; there were few qualitative differences between demented and age-matched subjects. These data indicate that Alzheimer's

patients may be unable to encode material. AD and HD patients showed pronounced but dissimilar deficits with visuospatial and constructional tasks. The behavioral data extend neuropathologic impressions of degeneration of the frontal striatal system in HD and temporo-parietal, cortical involvement in AD. With PD, performance decrements were less prominent and

many patients continue to function at an unimpaired level; dysfunctioning varied in relation to complexity and executive requirements, which aligned strongly with fronto-striatal changes. Unlike HD, PD patients usually showed fewer behavioral and personality changes; emotional expression was not one of disinhibition.

[175] Alzheimer's Disease and Driving

Harry Karlinsky, MD; Ruth Donnelly, PhD; Margaret Young, OT; Jean Ridgley, PhD

Toronto General Hospital, The Hugh MacMillan Rehabilitation Centre, Toronto, Ontario M4G 1R8 Canada

Sponsor: *Ontario Ministry of Transportation*

Purpose—This project will investigate whether there are any predictable relations among the severity of intellectual deficits, particularly those seen in Alzheimer's disease, selected neuropsychological tests that are related to driving ability, and the ability to drive a motor vehicle. There are between 240,000 and 288,000 Canadians with Alzheimer's disease (AD). In addition to the widely-known disorders in memory performance, individuals with AD also suffer from losses in other areas of cognition such as attention, reaction time, judgment, and visuo-spatial processing. Thus, there are a large number of Canadians who may be subject to cognitive deficits that can directly impact on their ability to operate a motor vehicle. Physicians in Ontario are required by law to report to the Ministry of Transportation those individuals considered unfit to drive. However, physicians have very little data upon which to base such a report.

Methodology—This study will test actual on-road driving performance as well as a variety of tests of cognitive functioning, visual processing, and reaction time in two groups of participants: individuals from the Toronto

General Hospital Alzheimer's Disease and Related Disorders (ADRD) Clinic who are cognitively impaired/not demented; and a group of control subjects of the same age as those in the patient groups. There will be 24 participants in each group, all currently driving or with valid licenses at the time of their entry into the study. Information also will be gathered by questionnaire regarding driving habits and accident history. These will be filled out by both the patients and their caregivers.

Future Plans—The data will be analyzed to determine whether any of our chosen variables predict actual driving test performance in our patient or control populations. If any predictors are significantly and highly correlated with driving performance, it may be possible for these tests to be used to support a physician's clinical impression of an individual's inability to drive safely.

Recent Publications Resulting from This Research

The Impact of Alzheimer's Disease on Driving Ability: A Review. Donnelly R, Karlinsky H, *J Geriatr Psychiatry Neurol* 3:67-72, 1990.